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# Differential Wavefield Velocity Imaging for Damage Visualization

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Ultrasonic propagation imaging or wavefield imaging has been widely used to evaluate structural damages and internal features. Inspecting complete wavefield time history for damage identification is tedious and error-prone. A more effective way is by extracting damage-related information into a single image. Various strategies were previously proposed but their effectiveness is generally dependent on exhaustive supervised learning. A differential wavefield velocity imaging method that maps the local deviation of group or phase velocity in a structure is proposed. It could be used in combination with any ultrasonic wavefield measurement system that acquires full wavefield time history over a two-dimensional rectilinear grid of inspection points on the structure. The proposed method measures deviation of wave velocity between two adjacent grid points and then assigned the value to respective image pixel with spatial information preserved. Actual differential values rather than arbitrarily-scaled intensities are presented, significantly increasing its potential to provide detailed quantitative information for damage evaluation. Performance comparison for homogeneous metallic and anisotropic composite materials will be given.

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